DOCUMENTATION HANDBOOK

LOCKHEED ELECTRONICS COMPANY
HOUSTON AEROSPACE SYSTEMS
A Division of Lockheed Aircraft Corporation

CR 101864

DOCUMENTATION HANDBOOK

LEC Document No. 644D.41.09

Prepared by:

Instrumentation Development Department
Lockheed Electronics Company
Houston, Texas

June 1969

FOREWORD

This handbook has been prepared to assist engineers in the preparation of technical documents to fulfill contractual obligations. Also included are a few helpful hints for preparing papers for scientific and engineering journals. It is hoped that those who labor over the difficult task of the design and development of a scientific instrument will be inspired to share their knowledge and achievement with others through publication in a journal or technical magazine.

OBJECTIVES

The objectives of this documentation handbook are the following:

- To establish uniformity of style, format, and abbreviation used in documentation produced by the Instrumentation Development Department.
- To improve efficiency by providing standards with which engineers, draftsmen, and typists can become familiar through use.

CONTENTS

CONTENTS (Concluded)

ILLUSTRATIONS

Section 1

PROCEDURES FOR DOCUMENT PREPARATION

The engineer prepares a handwritten manuscript following the format outlined in this writing guide. (See the flow chart shown in Figure 1-1.) He should ensure that his manuscript is legible (especially handwritten Greek symbols), contains the necessary illustrations, and is as comprehensive as possible. To allow room for changes and editorial marks, every other line of ruled writing pads should be used to prepare the manuscript. The engineer then submits the handwritten manuscript, along with the routine sheet (Figure 1-2), to his supervisor. The engineering supervisor initials the routing sheet and submits the manuscript to the technical writer for editing and typing.

The technical writer edits the manuscript, confers with the engineer concerning changes he has made or additional information that is required, and submits it for rough-draft typing. The illustrations are submitted to drafting by the technical writer when the handwritten manuscript is placed in typing. The document is then proofread and a copy is returned to the engineering supervisor for review.

The supervisor checks the current workload and estimates the date the review can be completed. The manuscript is then given a technical review by engineering personnel deemed most cognizant of the project by the supervisor. The reviewed manuscript is checked by the author for his concurrence and submitted to the technical writer by the supervisor for final typing if review changes are not extensive, or for another rough draft if there are many changes.

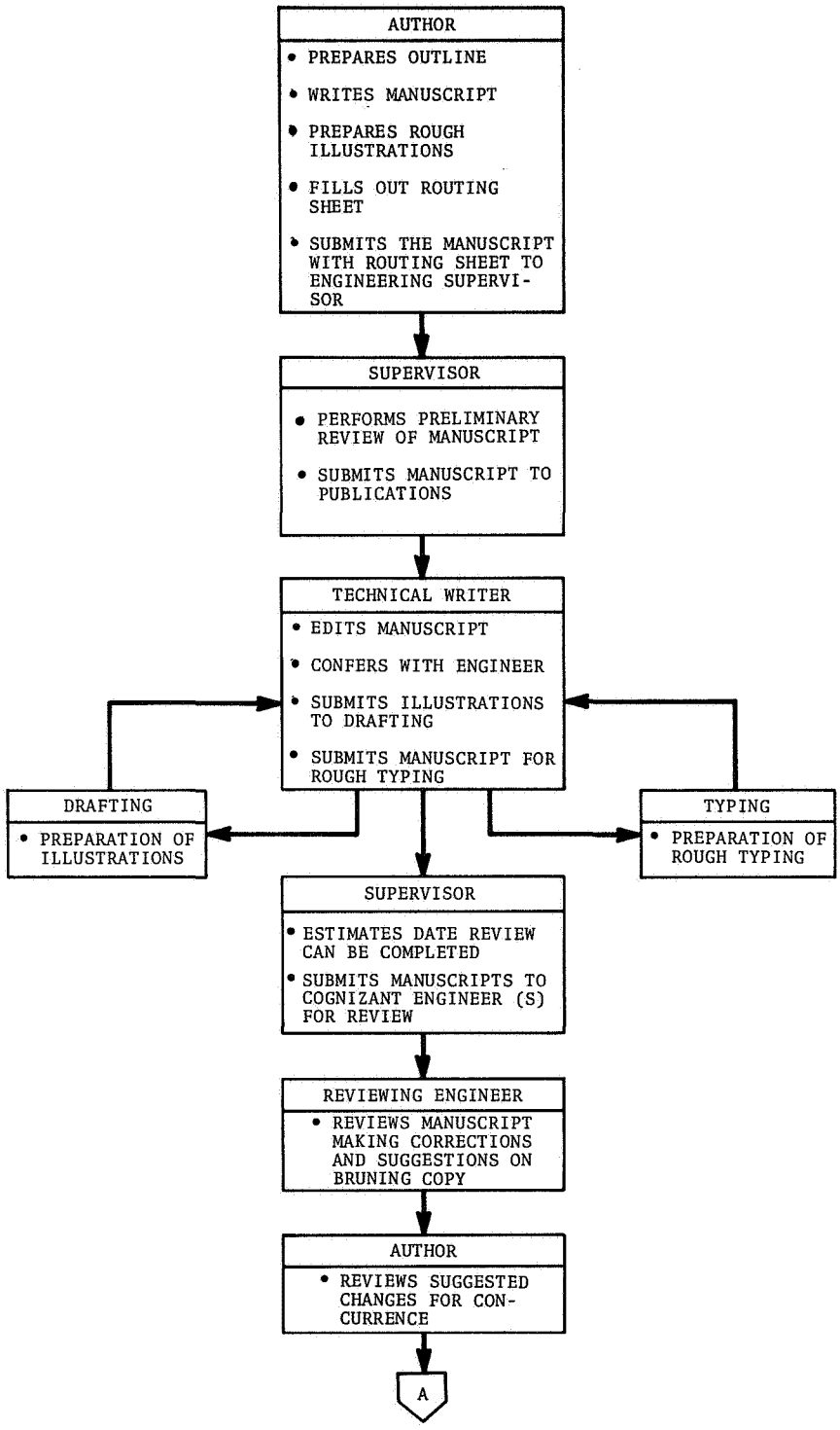


Figure 1—1. Document Flow

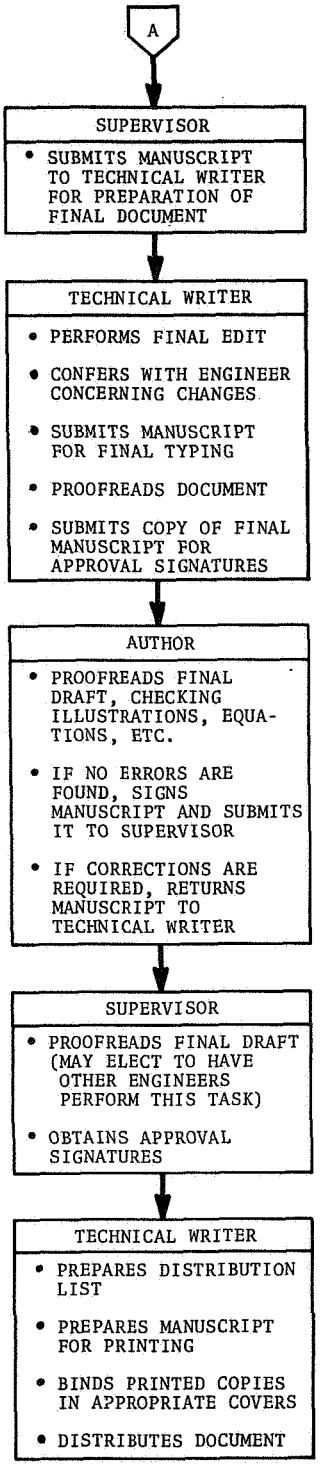


Figure 1–1. Document Flow (Concluded)

DOCUMENTATION ROUTING SHEET

REQUEST
(To be filled out by author)

AUTHOR _____ EXT. _____ DATE _____

DOCUMENT TITLE _____

ENGINEERING SUPERVISOR _____

SCHEDULE AND PREPARATION

TECHNICAL WRITER _____ DATE RECEIVED _____

TYPIST (ROUGH DRAFT) _____ DATE TO TYPING _____

PROOFREAD _____ DATE SUBMITTED FOR REVIEW _____

ENGINEERING REVIEW

ENGINEERING SUPERVISOR _____ DATE _____

REVIEWING ENGINEER(S) _____ DATE _____

_____ DATE _____

_____ DATE _____

ESTIMATED DATE
REVIEW COMPLETE _____

AUTHOR'S
CONCURRENCE _____ DATE _____

DATE REQUIRED _____

PREPARATION OF FINAL DOCUMENT

DATE RECEIVED FROM REVIEW _____ DATE FINAL EDIT COMPLETE _____

DATE FINAL TYPING COMPLETE _____

DATE TO PRINT SHOP _____

NO. COPIES DISTRIBUTED _____

LEC DOCUMENT NO. _____

PROOFREAD
AUTHOR _____ DATE _____
SUPERVISOR _____ DATE _____

DATE SUBMITTED FOR SIGNATURES _____

DATE DISTRIBUTED _____

LIBRARY FILE NO. _____

Figure 1-2. Sample Routing Sheet

A copy of the final manuscript along with the original approval page is submitted to the author for proofreading. If errors are found or additional changes are necessary, the manuscript is returned to the technical writer. If changes or corrections are not required, the manuscript is submitted to the engineering supervisor who is also responsible for proofreading and for obtaining approval signatures. A distribution list is prepared by the technical writer who has the required number of copies printed and appropriately bound with paper covers.

In order that management be kept fully aware of the status of documentation on all projects, the technical writer prepares a progress report on a biweekly basis. This report provides a listing of documents in progress, indicates the status of each of these documents (typing, review, etc.), and projects distribution dates. A sample progress report is shown in Figure 1-3.

DOCUMENTATION PROGRESS REPORT

WEEK ENDING _____

DOCUMENT	INITIAL DATE TO EDITING	NEXT SCHEDULED MILESTONE	ESTIMATED DATE OF NEXT MILESTONE	CURRENT STATUS	AUTHOR	PROJECTED DATE TO EDITING

CODE

RT - REVIEW TYPING
FT - FINAL TYPING
R - DOCUMENT IN REVIEW
P - DOCUMENT IN PRINTING
D - DISTRIBUTION OF DOCUMENT

NOTE: AN ASTERISK INDICATES THOSE DOCUMENTS THAT ARE BEHIND SCHEDULE.

Figure 1-3. Documentation Progress Report

Section 2

FORMAT AND WRITING GUIDE

2.1 FRONT MATTER

The material preceding the main body or text of a report is called the front matter and includes all or most of the following:

- Title Page
- Approval Page
- Abstract
- Acknowledgments
- Table of Contents
- List of Illustrations and Tables
- Glossaries

An explanation of the Abstract, Acknowledgment, and Glossary is given in the following paragraphs. See Figures 2-1, 2-2, 2-3, and 2-4 for examples of the title page, approval page, table of contents, and list of illustrations.

2.1.1 Abstract

The abstract briefly summarizes in one or two paragraphs the contents of the report. The abstract is placed on a separate page following the approval sheet.

2.1.2 Acknowledgments

If the author received more than routine assistance in the work being reported, it is proper to acknowledge this assistance. The acknowledgments are placed on a separate page following the abstract.

ELECTRON-BEAM ELECTRIC-FIELD METER
FEASIBILITY REPORT

LEC Document No. 644D.41.01

Prepared by:

Instrumentation Development Department
Lockheed Electronics Company
Houston Aerospace Systems Division
Houston, Texas

Under Contract NAS 9-5191

For

SPACE PHYSICS DIVISION

National Aeronautics and Space Administration
Manned Spacecraft Center
Houston, Texas

Figure 2-1. Title Page

ELECTRON-BEAM ELECTRIC-FIELD METER
FEASIBILITY REPORT

Prepared by: _____
W. R. Gardner
Instrumentation Development Department,
671-41

Prepared by: _____
Paul H. Blackmon
Instrumentation Development Department,
671-41

Approved by: _____
K. T. Swicegood, Supervisor
Instrumentation Development Department,
671-41

Approved by: _____
B. C. Hall, Department Manager
Instrumentation Development Department,
671-41

Instrumentation Development Department
Lockheed Electronics Company
Houston Aerospace Systems Division
Houston, Texas

Figure 2-2. Approval Page

TABLE OF CONTENTS

Figure 2-3. Table of Contents

TABLE OF CONTENTS (Concluded)

Figure 2-3. Table of Contents (Concluded)

ILLUSTRATIONS

Figure 2-4. List of Illustrations

2.1.3 Glossary

The glossary contains explanations of the more uncommon terms and abbreviations used in the report. Definitions and abbreviations may appear in the front matter if only one or two pages are involved. Lengthy or more detailed lists should be placed in an appendix to the report.

2.2 BODY OF THE REPORT

The text or body may be divided into as many sections as necessary to logically organize the material. The body of a technical report normally consists of the following parts:

- Introduction
- Discussion
- Conclusions and Recommendations
- References

2.2.1 Introduction

To understand the results of the investigation, the reader must know generally what was done and why. The introduction should provide a setting for the discussion by presenting background information, references to past history of the project, and other material that will contribute to the reader's understanding of the subject matter.

2.2.2 Discussion

Results and a discussion of these results, including charts, tables, and other illustrative material, are presented in this part of the report. The discussion usually consists of several sections while the introduction is normally

presented in only one section. The discussion should explain the results, point out any qualifications or limitations the results indicate, and bring to light any source of possible error. The discussion should also evaluate the results, and interpret and investigate their significance.

2.2.3 Conclusions and Recommendations

Conclusions, decisions, and judgments based on the evidence presented in the body of the report should be placed in this section. Although conclusions that stem from the discussion will appear in the text, they should be assembled and restated in this section with recommendations where applicable.

2.2.4 References

Other publications directly referred to in a report are listed under the heading "REFERENCES" and placed at the end of the discussion. References are numbered in the order of appearance and contain the following information: the author's name, the exact title of the work, the source, number of the report, and the year.

2.3 BACK MATTER

The back matter of the report consists of appendixes, material related to the study but too technical, detailed, or bulky to include in the text without disrupting the continuity of the report. Appendixes should be referenced in the text of the report and usually include the following:

- Data sheets showing raw data recorded during the test phase.

- Tables, graphs, or illustrations which are too large to fit conveniently in the body of the report.
- Tables, graphs or illustrations of secondary importance.
- Derivations of equations.
- Sample calculations.

2.4 FORMAT

Format is concerned with the physical appearance of the report, i.e., page sizes, typographical arrangement, paragraph numbering, etc. The main body of the report is divided into sections with each section broken down into paragraphs. An example showing the section and paragraph numbering system used is shown in Figure 2-5.

2.5 FOOTNOTES

Footnotes are indicated by an asterisk in the text or numbers in sequence if more than one occurs on a page. Footnotes are typed single-spaced below the hairline rule which separates the footnote from the main body of the text.

Section 6

TECHNICAL PROPOSALS

6.1 INTRODUCTION

A technical proposal is a publication designed to display ability to undertake a particular project and carry it to a successful conclusion. It is a sales document which sells ideas and capabilities relating to an end product which does not exist at the time.

The common purpose of all proposals is to persuade the persons to whom they are addressed that the bidder can do a certain job better than any other organization.

6.2 PROPOSAL CATEGORIES

There are three basic types of proposals. They are:

- The solicited proposal
- The unsolicited proposal
- The technical brochure

6.2.1 Solicited Proposals

In the case of solicited proposals, the potential customer issues invitations to a number of organizations which are competent in the technical field concerned. These invitations are called Requests for Proposals (RFP's) or Requests for Quotations (RFQ's). These requests present in detail the technical requirements for the work to be accomplished, and may even specify an outline for presentation of the required information.

Figure 2-5. Sample Page of Text

Section 3

WORD USAGE

The words listed below represent a standardization of word usage for this department. The abbreviations are as follows: u.m. (unit modifier), v. (verb), n. (noun), pref. (prefix), c.f. (combining form). The phase "usually one word" indicates that the prefix or combining form is printed solid, in most cases, with the word to which attached, e.g., deenergize, multichannel, microampere. The *U. S. Government Printing Office Style Manual* should be referred to when there is any doubt concerning the use of compound words.

A

a-c (u.m.)
ac (n.)
adapter
ampere-hour, -second, -minute
ANDed
AND-gate
audio frequency

B

backflash
backflow
backplate
backup (n., u.m.)
belt-driven (u.m.)
bi (pref.) one word
Binary 0
Binary 1
bright-colored (u.m.)
broadband (u.m., n.)
bus bar

C

cableway
cardholder
card-index (u.m., v.)
cell tester
checkout (n., u.m.)
circuit breaker
cogwheel
connector
console-mounted (u.m.)
converter
countdown
counterclockwise
crossbar
cross-connect
crossover (n., u.m.)
crosstalk
cutoff (n., u.m.)

D

d-c (u.m.)
dc (n.)
de (pref.) usually one word
deenergize
di (pref.) one word

E

electro (c.f.) usually one word

F

fade-in (n., u.m.)
fadeout (n., u.m.)
feedback (n., u.m.)
filecard
flange nut
flashover (n., u.m.)
flip-flop
flowmeter
f-m
foldout (n.)
foot-lambert
foot-pound
full wave (u.m.)
fuse block
full wave (n.)

G

gage
gearbox
gear-driven (u.m.)
gear-operated (u.m.)
gear wheel
glowmeter
gram-meter
gray
groundwave
gyrocompass
gyromechanism

H

half speed
half wave
high frequency
high-power (u.m.)
high-pressure (u.m., v.)
high speed (n.)
high-speed (u.m.)

I

I-beam
infrared
inter (pref.) usually one word
intra (pref.) usually one word

J

j-bolt
joulemeter

K

keyboard
keyword
kilohm

L

left-hand (u.m.)
lift-off
loadline
locknut
lockwasher
Logic 1
Logic 2
low-power (u.m.)
low-frequency
lumen-hour

M

magneto (c.f.) usually one word
micro (c.f.) usually one word
mid (c.f.) usually one word

mil-foot
milli (c.f.) usually one word
multi (c.f.) usually one word

N

NAND-gate
narrow band
non (pref.) one word

O

odd number
odd-numbered (u.m.)
offcenter (u.m.)
ohm-ammeter
ohmmeter
one-half
ORed
OR-gate
O-ring
OR-strapped

P

patch board
patch cord
patch panel
patchword
percent
phasemeter
playback (n., u.m.)
plug-in (n., u.m.)
postamplifier
pound-foot
power-driven (u.m.)
powerline
power-operated (u.m.)
preamplifier
push-pull (u.m.)

Q

quarter-wave (u.m.)

R

radarscope
right-angle (u.m., v.)
right-hand (u.m.)

S

saw-toothed (u.m.)
servoamplifier
setscrew
shunt winding
shunt-wound (u.m.)
sine wave
single-phase (u.m.)
slipring
sound wave
spring lock
square wave
S-shaped

T

timelag
T-junction
turnoff (n., u.m.)
turn-on (n., u.m.)
tuneup (n., u.m.)

U

ultrahigh frequency
U-magnetic

V

valve gear
voltammeter
volt-ampere
voltohmmeter
volt-second

W

warmup (n., u.m.)
watt-hour
wattmeter

waveform
waveguide
wavelength
wide band
wire gage

X,Y,Z

X-ray
Y-joint
zero beat

MISCELLANEOUS

0-input
0-state
1-state
VCD or VAC (in tables and drawings only)

Section 4

ABBREVIATIONS

Abbreviations in this handbook have been assembled from a number of sources, mainly the various internal style manuals used by scientific journals and the "NASA Publications Manual." Where a conflict in usage was found, the "NASA Publications Manual" was given precedence over other sources. A general rule in the use of abbreviation is to spell out the word or phrase the first time it is used in text, placing the abbreviation after it in parentheses.

absolute (as a unit)	abs
absolute ampere	abamp
alternating current	ac
altitude	alt
American Standards Association	ASA
ampere	A
ampere combining form	a
ampere-hour	A-h
and (in proper names when so given)	&
and others	et al.
and so forth	etc.
angstrom	$\mathring{A}$
anno Domini	A.D.
ante meridiem	a.m.
antilogarithm	antilog
approximate	approx
atmosphere, standard	A_s
atmospheres	atm
atomic mass units	amu

atomic weight	at. wt
audio-frequency (adj.)	af
average	av
balance	bal.
Baumé	Bé
billion electron volts	BeV
boiling point	bp
bottom center	B.C.
British thermal units	Btu
calculated	calc
calorie	cal
Calorie	Cal
Celsius (centigrade)	C
center of buoyancy	c.b.
center of gravity	c.g.
center of mass	c.m.
center to center	c. to c.
centigram	cg
centimeter	cm
centimeter-gram-second	cgs
chapter, chapters	ch., chs.
circular mils	cir. mils
coefficient	coeff
cologarithm	colog
constant	const
contact potential difference	cpd
continuous wave	cw
cosecant	csc
cosine	cos

cotangent	cot
coulomb	C
counts per second	counts/sec
critical	crit.
cubic	cu
cubic centimeter	cc or cm^3
cubic inch	cu in. or in^3
curie	Ci
cycle	spell out
cycles per minute	cpm
cycles per second	cps, Hz
debye	D
decibel	dB
degree (separated from numbers)	deg
degree (with numbers and in °F, °R, °C, and so forth)	°
degrees Baumé	°B
degrees Celsius (centigrade)	°C
degrees Fahrenheit	°F
degrees Kelvin (absolute)	°K
degrees Rankine	°R
diameter	diam
direct current	dc
disintegrations per second	dis/sec
ditto	do.
dyne	dyn
east	E
efficiency	eff.
electric, electrical	elec.
electromagnetic units	emu

electromotive force	emf
electron volts	eV
electrostatic units	esu
equation, equations	eq., eqs.
eng	e
experiment, experimental	exp.
exponential	exp
exponential integral	Ei
external	ext.
farad	F
feet per minute	ft/min
feet per second	fps or ft/sec
feet per second per second	ft/sec^2
fermi ($=10^{-13}$cm)	F
figure, figures	fig., figs.
foot	ft
foot-lambert	ft-L
foot-pound	ft-lb
for example	e.g.
franklin	Fr
frequency modulation	FM
gauss	G
gilbert	Gi
government	govt.
gram	g
gram-calorie	g-cal
henry	H
hertz (cycle per second)	Hz

horsepower	hp
horsepower-hour	hp-hr
hour	h or hr
inch	in.
inches of mercury	in. Hg
inches of water	in. H_2O
inch-pound	in-lb
indicated horsepower	ihp
indicated mean effective pressure	imep
initial temperature difference	ITD
inside diameter	i.d.
intermediate frequency	i.f.
internal	int.
international	int.
international angstrom	IÅ
International Critical Tables	ICT
International Standards Association	I.S.A.
iron pipe size	I.P.S.
joule	J
kaiser	K
kilocalorie	kcal
kilocycle/second	kc/sec or kcps
kiloelectron volt	keV
kilogauss	kG
kilogram	kg
kilogram-calorie	kg-cal
kilogram-meter	kg-m
kilogram weight	kg-wt

kilohm	kΩ
kilojoule	kJ
kiloliter	kl
kilometer	km
kilo-oersted	kOe
kilovolt	kV
kilovolt-ampere	kVA
kilowatt	kW
kilowatt-hour	kWh
kinetic energy	KE
kips per square inch	ksi
laboratory	lab
lambert	L
latitude	lat
leading edge	L.E.
left hand	l.h.
limit	lim
limited	ltd.
linear	lin.
liquid	liq.
liter	spell out
logarithm (common)	log
logarithm (natural)	$\log_e$ or ln
lux	lx
magnetomotive force	mmf
magnified fifty times	×50
maximum	max.
maxwell	Mx
mean aerodynamic chord	M.A.C.

mean effective pressure	mep
mean geometric chord	M.G.C.
megacycle/second	Mc/sec
megohm	MΩ
melting point	mp
meter	m
meter-kilogram-second	mks
microampere	μA
microangstrom	μÅ
microcoulomb	μC
microfarad	μF
microinch	μin.
micromicrofarad	μμF
micromole	μM
micron	μ
microsecond	μsec
mile	spell out
miles per hour	mph
milliampere	mA
millicurie	mCi
milligram	mg
millihenry	mH
milliliter	ml
milli-mass-units	mmu
millimeter of mercury	mm Hg, torr
millimicron	
millimole	mM
million electron volts	MeV
million volts	MV
minimum	min.
minute	min

minute (angular measure)	'
miscellaneous	misc
molar	M
mole	spell out
month (as a unit)	spell out
months (for any language)	Jan., Feb., Mar., Apr., Aug., Sept., Oct., Nov., Dec.
namely	viz
nanosecond	nsec
nautical mile	n.mi.
neper	Np
newton	N
north	N
nuclear magneton	nm
number, numbers	no., nos. or No., Nos.
observed	obs
oersted	Oe
ohm	spell out or Ω
ounce	oz
outside diameter	o.d.
page	p.
pages	pp.

percent	spell out or %
picofarad	pF
poise	p
post meridiem	p.m.
potential difference	PD
pound	lb
pound-foot	lb-ft
pound-inch	lb-in.
pounds per brake horsepower-hour	lb/bhp-hr
pounds per square inch	lb/sq in., lb/in^2, or psi
pounds per square inch absolute	psia
probable error	pe
radian	rad
radio-frequency (adj.)	rf
radius (no period when a unit)	rad.
reference, references	ref., refs.
revised (spell out if confusing)	rev.
revolution	rev
revolutions per minute	rpm
revolutions per second	rps
right hand	r.h.
roentgen	R
root mean square or square root of mean square	rms
rydberg	Ry
secant	sec
second	sec or s

second (angular measure)	"
section	Sec.
sine	sin
slug-feet^2	slug-ft^2
south	S
specific gravity	sp. gr.
specific heat	sp. ht.
square	sq
square centimeter	cm^2 or sq cm
square inch	sq in. or in^2
standard temperature and pressure	STP
steradian	sr
tangent	tan
temperature	temp.
tesla (Wb/m^2)	T
that is	i.e.
theoretical	theor.
thousand pounds	kip
thrust horsepower	thp
top center	T.C.
trailing edge	T.E.
ultrahigh frequency	uhf
ultraviolet	uv
university	univ.
velocity	vel.
versus	vs
volt	V
volume, volumes	vol, vols.

watt. . . . . W
weber . . . . . Wb
weight. . . . . wt
west. . . . . W

x units . . . . . xu

yard. . . . . yd
year. . . . . yr

Metric Prefixes

Prefix	Multiplying factor	Abbreviation
deci	10^{-1}	d
centi	10^{-2}	c
milli	10^{-3}	m
micro	10^{-6}	μ
nano	10^{-9}	n
pico	10^{-12}	p
femto	10^{-15}	f
atto	10^{-18}	a
deca	10^{1}	da
hecto	10^{2}	h
kilo	10^{3}	k
mega	10^{6}	M
giga	10^{9}	G
tera	10^{12}	T

Section 5

TYPING STANDARDS

5.1 SETTING UP EQUATIONS

1. Short, simple equations are sometimes run into text. (Punctuation may or may not precede such an equation.) These equations should not be broken at the end of a line.
2. Longer equations are set off from the text by spacing. These equations should be centered on the page.
3. When it is necessary to break a long equation, break before equal signs, if possible, and aline the equal signs.
4. If it is necessary to break an equation at places other than the equal signs, aline the + or - signs of the succeeding lines with the first character after the equal sign. The longest line is centered.
5. When it is impossible to aline parts of the equation on the equal signs, the longest line is centered and the other lines are alined on the right of the longest line.
6. Equations may be broken before trigonometric functions such as cos, sin, and tan.
7. Chemical equations are set up similarly to mathematical equations. If it is necessary to break a chemical equation between lines, the division should be at the arrow or equal sign. Division at a plus sign is permissible if the plus sign is not used to indicate a positive ion as in Mg^{+}.

8. If two or more equations appear together, allow enough space between them to indicate that they are different expressions. Leave more space between two equations than is left between the lines of the same equation.
9. Equations containing a succession of integral signs may be broken before the integrals. The succeeding lines are alined on the right of the equal marks.
10. Related equations that are not separated by text should be alined on the left and centered according to the longest line of the group.
11. Parentheses, brackets, and braces — in that order — are used to enclose a part of a mathematical expression used as a unit. If another set of enclosing symbols is needed, use large parentheses.
12. Any explanatory information with an equation should be typed to the right of the equation, leaving adequate space between the equation and the explanatory information so that it is readily apparent that it is not a part of the equation.
13. When lim, max, or min are used in equations, type these words on the main line, and center the indexes under the words.
14. Equations that cannot be broken and are longer than the width of a page may be typed lengthwise on the page or typed on a separate sheet and reduced to fit either the width or length of the page.

5.2 SPACING AND PUNCTUATION OF SOME TYPICAL EXPRESSIONS

xy-plane — a plane which contains the x and y coordinates

x-axis

x, y, z axes

x, y, z coordinate system

x, y, z system

dd80

S-C 4020

$$F(x) = \int_a^b f(x)\,dx = [F(x)]_a^b \tag{1}$$

$$\int Kf(x)\,dx = K\int f(x)\,dx \tag{2}$$

$$\int \frac{1}{\sqrt{a^2 - x^2}}\,dx = \arccos\frac{x}{|a|} \tag{3}$$

$$|X| + a(1 - y)z\,dx \tag{4}$$

$$\frac{\partial f}{\partial x}\frac{dx}{dt} = \alpha\frac{\partial f}{\partial x} + \frac{\partial f}{\partial y}\beta \tag{5}$$

5.3 TYPING ELEMENTS FOR EQUATIONS (IBM Selectric Typewriter)

1. Use delegate element for typing numbers or letters on the main line of an equation. (This line is typed in delegate.)
2. Use symbol 10 element for typing Greek characters on the main line of an equation. (Example: $\alpha \lambda \delta$)
3. Use the Courier 12 element for typing all numbers or letters (also parentheses, ±, +, -) that are the sub- or superscripts of an equation. (Example: $a^{1} d\omega_{1-n} f(x)_{(2t-x)}$)
4. Use the symbol 12 element for typing greek characters that are the sub- or superscripts of an equation. (Example: $f(x)_{\lambda} 2t^{\omega}$)

5.4 TYPING GUIDELINES

- Typing guide sheets (Form 885) should be used for typing final documents. The guide sheets contain blue-lined margin guides which will not reproduce.
- Errors on final drafts should be splice-corrected using a light table and standard splicing tape.
- Rough-draft manuscripts should be typed double-spaced, while final drafts should be typed 1-1/2 spaces.
- The typing format shown in Figure 5-1 should be used as a guide when preparing reports and most other technical documents for the department. An exception would be the preparation of specifications. The format for specifications is shown in Figure 5-2.

Section 1

SAMPLE REPORT LAYOUT

1.1 FIRST-ORDER HEADING

2-1/2#

XXXXXXXXXXXXXXXXXXXXXXXXX(text)XXXXXXXXXXXXXXXXXXXXXXXXXX

2-1/2#

1.1.1 Second-Order Heading

XXXXXXXXXXXXXXXXXXXXXXXXX(text)XXXXXXXXXXXXXXXXXXXXXXXXXX

1.1.1.1 Third-Order Heading. XXXXXXXXX(text)XXXXXXXXXXXXX

1.1.1.1.1 Fourth-Order Heading. XXXXXXXXXXX(text)XXXXXXXX

—5#—● Bullet listings (nonsequential)

● XXXXXXXXXXXXXX(text)XXXXXXXXXXX

1.1.1.1.2 Another Fourth-Order Head. XXXXXXXXX(text)XXXXX

—5#—a. Sequential listing as normally used

b. XXXXXXXXXXXXXX(text)XXXXXXXXXXXXXXX

—— 9# ——1. Subsequential listing as normally used

2. XXXXXXXXXXXXXXX(text)XXXXXXXXXXXXXXX

———13#———● Subsequential listing as normally used

● XXXXXXXXXXXXXXXXX(text)XXXXXXXXXXXXXXX

1.2 ANOTHER FIRST-ORDER HEAD

XXXXXXXXXXXXXXXXXXXXXXXXX(text)XXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXX(text)XXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXX(text)XXXXXXXXXXXXXXXXXXXXXXXXXX

Figure 5-1. Typing Format, Report Layout

1. FIRST-ORDER HEADING

1.1 Second-Order Heading. – A second-order head may have text run in, as in this example, or it may stand alone.

1.1.1 Third-Order Heading. – Third-order headings look exactly like second-order headings, except that they always have a run-in, unless subheadings follow immediately.

1.1.1.1 Fourth-Order Heading. – Note that all headings except the first-order are initial capped, underlined, and followed by a period and a hyphen. Fifth- and sixth-order headings are the same, except that the paragraph numbers are longer.

——12#—— a. Sequential listings are alined with the headings.

b. XXXXXXXXXXXXXXXXXXX(text)XXXXXXXXXXXXXXXXX

————16#———— 1. Subsequential listings are alined with the first word of the preceding sequential listing.

2. XXXXXXXXXXXXXXXXXXXX(text)XXXXXXXXXXXXX

1.1.1.2 Another Fourth-Order Heading. – XXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXX(text)XXXXXXXXXXXXXXXXXXXXXXXXXX

——12#—— • Bullets (nonsequential listings) are also alined with the headings.

• XXXXXXXXXXXXXXXXXXXX(text)XXXXXXXXXXXXXXXXXX

• XXXXXXXXXXXXXXXXXXXX(text)XXXXXXXXXXXXXXXXXX

1

Figure 5-2. Typing Format, Specification Layout

- At least two lines of a paragraph should appear at the top or bottom of a page.
- A free-standing heading should never appear at the bottom of a page unless at least two lines of text follow.
- When sequential or nonsequential listings are split, at least two listed items should appear at the bottom or top of the pages involved.

Section 6

TECHNICAL LIBRARY

Copies of all documents distributed by the department are maintained in the library. Original manuscripts are filed and additional copies can be ordered when required. A library card listing the author, date of distribution, title, and library file number is prepared for each document.

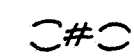
The file numbers consist of five-digit numbers. The first digit on the left represents the year (9 for 1969). The second digit from the left indicates the document category. The remaining three digits are consecutive numbers from 0 to 99 to identify each document within a category. Listed below are the file number series and corresponding document categories:

90000 – 90999	Technical Reports
92000 – 92999	Manuals
93000 – 93999	Specifications
94000 – 94999	Scientific Papers, News Releases, other documents for publication

Appendix A

EDITORIAL AND PROOFREADING MARKS

The editorial and proofreading marks commonly used for typewritten material are listed below. Each mark should be indicated not only within the copy but also in the margin. (Unless the number of marks warrants the use of both margins, the marks are normally placed in the right-hand margin.) Placement in the margin will (1) increase the likelihood that the typist does not overlook the need for instructions, and (2) enable the author and editor, in their final proofreading, to verify that all indicated corrections have been made. When a line contains more than one error, the notations in the margin are arranged to read from left to right and are separated from each other by a slash mark (solidus).

Mark Used in Margin	Explanation	Example of Mark Used Within Copy
	Delete	shock ~~shock~~ tubes
	Delete and close up	not u~~s~~eable
	Close up	missile borne
	Close up to one space	reports were prepared
	Capitalize	doppler effect
	Place in lowercase	a Pitot tube
	Capitalize first letter; lowercase the remainder	LOCKHEED ELECTRONICS COMPANY

Mark Used in Margin	Explanation	Example of Mark Used Within Copy
	Insert comma	atomic, molecular^ and nuclear
	Insert apostrophe or single quote	in the low 50^s
	Insert quotation marks	chapter entitled^ Special Facilities^
	Insert period	12-in^ radius
	Insert semicolon	coordinates^ however, two types were
	Insert colon	the following theory^ When several
	Insert hyphen	high^ altitude conditions
	Leave hyphen in	inspector will spot= check the equipment
	Insert dash	two programs^ Polaris and
	Insert parentheses	transitions^ i.e., line spectra^
	Insert question mark	entitled "Will Nuclear Tests Continue^"
	Leave space	molecular^ energy
	Transpose letters or words	proposed program study
	Spell out	Wright-Patterson AFB
	Restore word crossed out; literally, let it stand	~~continuous~~ absorption coefficients
	Replace imperfect letter	feasibility study

Mark Used in Margin	Explanation	Example of Mark Used Within Copy
insert, see copy	Insert omitted material*	is consistent ^ previously presented
¶	Make new paragraph	low-pressure tubes. /Other factors
no ¶	Run into same paragraph	the past year. This program consists of
]	Move to right	10.6 0.8]
[	Move to left	10.62 [0.8
⌐¬	Move up	temperature ⌐range¬ of
L_J	Move down	temperature L range _J of
][	Center	]Temperature Range[
↷	Move to position indicated	absence ↑ of patterns of some types
‖	Aline	personnel facilities equipment
—/	Underscore	listed under the heading Dimensions

*When the omitted material is brief, it may be written in the margin.

Appendix B

GREEK LETTERS

α	alpha
β	beta
γ, Γ	gamma
δ, Δ	delta
ε	epsilon
ζ	zeta
η	eta
θ	theta
ι	iota
$\S$	kappa
λ, Λ	lambda
μ	mu
ν	nu
ξ, Ξ	xi
π, Π	pi
ρ	rho
σ, Σ	sigma
τ	tau
υ, Υ	upsilon
ϕ, Φ	phi
χ	chi
ψ, Ψ	psi
ω, Ω	omega

Appendix C

SUGGESTED TECHNIQUES FOR THE PREPARATION OF SCIENTIFIC PAPERS

BEFORE WRITING

Adequate prewriting preparation can do much both to ensure a logical, readable paper and to shorten the writing time. The principal phases of essential preparatory work are covered by the following directions.

1. ANALYZE THE PROBLEM. This analysis should include asking yourself at least these four questions:
   a. Exactly what information do I wish to present in this paper?
   b. For what specific group of readers am I writing?
   c. What background information can I assume these readers possess?
   d. What is the most logical sequence in which to present the information?
2. MAKE A DETAILED OUTLINE. This outline will serve as your writing guide; therefore, make as many subdivisions as possible. As your write you almost certainly will revise the outline – perhaps quite drastically. Nevertheless, the very act of preparing it initially and then modifying it is a mental stimulus that will go far toward assuring logical development of the subject matter. The major headings of the outline in its final form can constitute the table of contents if the paper is long enough to warrant such a table.

3. PLAN TABLES AND ILLUSTRATIONS. Give careful thought to what material, if any, should be presented either in tabular form or as illustrations. Editors generally frown on unnecessary duplication of results in tables and illustrations. Therefore, do not force your material into either tables or illustrations, but make conveying your message as efficiently as possible the only criterion for selecting particular forms of presentation.

WRITING THE PAPER

The Introductory Paragraphs

The scientific paper should contain at least one or two introductory paragraphs. If well done, the introduction will go far toward orienting the reader properly toward the document before him. The following steps are suggested for preparation of the introduction:

1. Make the precise subject of the paper clear.
2. Indicate the scope of the paper's coverage of the subject.
3. State the purpose of the paper.
4. Indicate the plan of organization of the paper.

The Main Body of the Paper

The "main body" of a scientific paper is the "meat" of the document, the real reason for the existence of the published paper. After writing the body of the paper, read it over slowly and thoughtfully, asking yourself the following questions:

1. Have I included all information necessary to convey my message?
2. Have I given adequate emphasis to the most important ideas and have I properly subordinated those of lesser significance?
3. Is the development of the subject matter logical and free from what would seem to the reader to be gaps and discontinuities?
4. Have I made the best possible use of graphs, charts, line drawings, and photographs?
5. Are the facts I have presented adequate to support the conclusions I expect to draw?

Now, revise the first draft in light of your answers to these and other questions that may occur to you as you reread the material.

The Concluding Paragraphs

Typical functions of the concluding paragraphs of the scientific paper include (a) summarization, (b) statement of specific conclusion, and (c) presentation of recommendations. The objective may be any one or any combination of these.

Summarization is most likely to be the major function in an informational paper. If you decide to include a summary, make certain (1) that you actually summarize the principal information in the main body, and (2) that you include only material that appeared earlier in the paper in expanded form.

Conclusions may be defined as convictions arrived at on the basis of evidence previously presented. If specific conclusions are to appear in your terminating paragraphs, make certain (1) that they stem from data presented earlier in the paper, and (2) that they are consistent with your introductory paragraphs in that they fulfill any promise made to the reader as to what your paper would prove.

Recommendations appear more often in technical reports than in scientific papers. If, however, you decide to include specific recommendations in the concluding paragraphs make certain (1) that they follow logically from data and conclusions previously stated, and (2) that the recommendations do not clash with what your introductory paragraph may have led the reader to expect.

ACKNOWLEDGMENTS

Acknowledgments should be presented at the end of the paper under a principal heading, "Acknowledgments." It is customary to acknowledge financial support in a footnote to the title.

APPENDIXES

Appendixes are used to present supplementary material which (1) is necessary for completeness but which, if inserted in the main body of the paper, would detract from the orderly presentation of the work; or (2) may be omitted by the general reader but would be valuable for the specialist in the field.

SELECTION OF A TITLE

The time to select the title is after the manuscript has been completed. The title should be both brief and succinct and definitive of the paper's subject content.

FINAL TOUCH OF THE GILDED PEN

Finally, when you have completed the first draft of the manuscript, lay it aside for a few days. Then go over it carefully and check the contents against the suggestions offered here.

A majority of the readers of a scientific paper skim through it to get a general idea of the procedure or results. It is important to ensure that these readers will get an

adequate picture of the contents of the paper from skimming. Are the tables and illustrations self-explanatory? Are the abstract, introduction, and concluding paragraphs concise, yet understandable? In short, try constantly as you write to put yourself in the place of your reader.

WRITING THE ABSTRACT

The abstract should be informative, summarizing the principal facts and conclusions and maintaining the pattern of emphasis of the paper. It should be intelligible and complete in itself since it may appear later in an abstract journal.

1. The abstract should indicate the subject dealt with and state the objectives of the work discussed.
2. Describe the kind of treatment given the subject by one or more such terms as brief, comprehensive, exhaustive, preliminary, experimentative, theoretical.
3. Summarize the newly observed facts, the experimental or theoretical findings, the conclusions, and other significant items in the paper.